

Response to reviewer #4 – M. Santee

We thank Michel Santee for her new corrections to clarify unclear sentences. All the minor comments and technical corrections have been addressed/implemented in the new version of the manuscript, as follows:

[L139-141: This sentence is written in an awkward and confusing manner (plus there is a stray “)” at the end). If I understand it correctly, it would be clearer to say something like: “Together, weaker sensitivity above very cold surfaces with a degrees of freedom for signal (DOFS) of 0.95 and poor knowledge of the seasonally and wavenumber-dependent emissivity above ice surfaces induce larger forward model errors, and consequently the largest measurement errors occur over the Antarctic.”]

Rewritten for clarity: “The highest retrieval error measured over the Antarctic arises from a weaker sensitivity above very cold surface with a degrees of freedom for signal (DOFS) of 0.95, as well as from a poor knowledge of the seasonally and wavenumber-dependent emissivity above ice surfaces.”

[L157: number of iteration --> number of iterations]

Done

[L225: This sentence refers to the “red vertical line” in Fig. 3c, whereas the Fig. 3 caption mentions “The orange horizontal or vertical lines”. It would be better to draw all of the lines marking 195 K in Fig. 3 in the same color and refer to them consistently.]

Corrected: “The red ...” → “The orange ...”

[L226: a large interannual variability --> the large interannual variability]

Done

[L266-267: “at exactly or a few days after the detection of the 195 K threshold temperature” is awkward and unclear wording. Moreover, I do not think that “detection” is the right word here – it is not that the 195 K threshold is being “detected”, but rather that it is being crossed. Finally, the only additional information that this phrase conveys beyond “around the time that temperatures drop below the 195 K threshold”, as already stated in L266, is that sometimes the strongest rate of HNO₃ depletion is seen a few days after the 195 K threshold is crossed, particularly in 2009. However, emphasizing the delay obscures the fact that occasionally the strongest rate of HNO₃ depletion appears to *precede* (not follow) the date on which temperatures drop below 195 K, as in 2013 (and to a lesser extent 2014 as well), according to Fig. 4. Thus I feel that it would be better to simply delete that entire parenthetical comment.]

Rewritten for clarity: “... is found closely around the time that temperatures drop below the 195 K threshold (except for the year 2009 that shows a longest delay) ...”

[L304: I find the insertion of the word “annual” in front of “average” in this line confusing. My understanding is that the red vertical dashed lines mark the 10-yr (2008–2017) average of the dates corresponding to the 50-hPa drop temperatures found for each year. As such, this value does not represent an “annual average”.]

Deleted: “... indicates the annual average of the dates ...” → “... indicates the average of the dates ...”

[L311: A closing “)” is missing after “530 K”.]

Added

[L311-312: My previous comments about L266-267 also apply to the phrase “An exact timing or a delay of a few days between the detection of the averaged 195 K threshold temperature ...”.]

Rephrased to: “Like for Fig.4, an exact timing or a few days between the time that temperatures drop below the 195 K threshold and the start of the HNO₃ depletion is visible every year in Fig. 6. A longest delay is also observed for the year 2009.”

[L313-315: Again, “detection” is not really the right word; also, the sentence is grammatically awkward. I suggest instead “The mismatch between the 10-year averages of the dates on which the 195 K temperature threshold is crossed and the dates for the drop temperatures (see Fig. 5 a and b) is driven by the year 2013, which ...” (i.e., add the comma after “2013”)]

Changed to: “Note that the mismatch between the 10-year average of the dates on which the 195 K threshold temperature is reached and that of the dates for the drop temperatures (see Fig. 5 a and b) is driven by the year 2013, which ...”

[L325 and 327: 10⁻⁵ K.m².kg⁻¹.s⁻¹ --> 10⁻⁵ K.m² .kg⁻¹ .s⁻¹ (missing superscripts)]

Done